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**United States Patent** [19]**Kamimura et al.**[11] **Patent Number:** **5,868,114**[45] **Date of Patent:** **Feb. 9, 1999**[54] **AIR FLOW RATE CONTROL APPARATUS**

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5,452,697	9/1995	Sasaki et al.	123/399
5,490,487	2/1996	Kato et al.	123/399
5,517,966	5/1996	Kanazawa et al.	123/399

**FOREIGN PATENT DOCUMENTS**

0 315 794 A3	5/1989	European Pat. Off.
0 317 813 A3	5/1989	European Pat. Off.
0 596 392 A1	5/1994	European Pat. Off.
34 05 935 A1	5/1985	Germany
61-8441	1/1986	Japan
3-50338	3/1991	Japan
62-35334	8/1994	Japan
WO 91/02890	3/1991	WIPO

**Related U.S. Application Data**

[63] Continuation of Ser. No. 583,794, Jan. 16, 1996, abandoned.

[30] **Foreign Application Priority Data**

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[51] **Int. Cl.<sup>6</sup>** ..... **F02D 11/10**; **F16K 31/04**[52] **U.S. Cl.** ..... **123/399**; **251/129.11**; **73/117.3**;  
**73/118.2**[58] **Field of Search** ..... **123/396**, **361**,  
**123/399**, **403**; **251/129.11**; **73/116**, **117.3**,  
**118.1**, **118.2**[56] **References Cited****U.S. PATENT DOCUMENTS**

4,840,349	6/1989	Peter et al.	251/129.11
5,036,816	8/1991	Mann	123/399
5,074,266	12/1991	Kuhn et al.	123/399
5,094,212	3/1992	Kawaguchi et al.	123/470
5,141,070	8/1992	Hickmann et al.	180/197
5,297,521	3/1994	Sasaki et al.	123/396
5,431,141	7/1995	Kanazawa et al.	123/399

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A throttle control apparatus for an engine on a vehicle is provided, in which the number of component parts in the position detection means and the driven means is reduced to improve the accuracy in its position control and at the same time an integrated wiring is achieved and connectors are aggregated. The position detection means for detecting the position of a control valve, the driven means for controlling the position of the control valve, the means for processing control signals, an output from the position control means for controlling the position of the control valve are disposed within a sealed space defined by a body supporting a control valve shaft, and a cover. Based on the fact that the number of component parts of the position detection means may be reduced, the mechanical hysteresis and electrical hysteresis may also be reduced to improve the accuracy in controlling the control valve position, and it is possible to aggregate the connectors.

**20 Claims, 6 Drawing Sheets**